Cognitive Psychology: Thinking, Intelligence, and Language

Chapter 8

SHOUT
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Chapter 8 Learning Objective Menu

- LO 8.1 How people use mental images to think
- LO 8.2 Nature of a concept
- LO 8.3 Methods people use to solve problems and make decisions
- LO 8.4 Artificial intelligence
- LO 8.5 Barriers to solving problems
- LO 8.6 Creative thinking
- LO 8.7 Definition of intelligence
- LO 8.8 How intelligence tests measure intelligence
- LO 8.9 How intelligence tests are constructed
- LO 8.10 Mental retardation and what causes it
- LO 8.11 Giftedness
- LO 8.12 Does intellectually gifted guarantee success
- LO 8.13 Theories of intelligence and how they differ
- LO 8.14 Influence of heredity and environment on intelligence
- LO 8.15 Language
- LO 8.16 Elements and structure of language
- LO 8.17 Language's influence on thinking
- LO 8.18 Animal capability of learning language
- LO 8.19 Ways to improve thinking

Thinking and Mental Images

- Thinking (cognition) - mental activity that goes on in the brain when a person is organizing and attempting to understand information and communicating information to others.
- Mental images - mental representations that stand for objects or events and have a picture-like quality.

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Concepts

- Concepts - ideas that represent a class or category of objects, events, or activities.
- Superordinate concept - the most general form of a type of concept, such as “animal” or “fruit.”
- Basic level type - an example of a type of concept around which other similar concepts are organized, such as “dog,” “cat,” or “pear.”

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Concepts

- Subordinate concept – the most specific category of a concept, such as one's pet dog or a pear in one's hand.
- Formal concepts - concepts that are defined by specific rules or features.
- Natural concepts - concepts people form as a result of their experiences in the real world.
- Prototype - an example of a concept that closely matches the defining characteristics of a concept.

A platypus is a "fuzzy" natural concept

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TABLE 8.1 FROM PROTOTYPES TO ATYPICAL EXAMPLES (MOST TYPICAL TO LEAST TYPICAL)

Vehicles	Fruit
Car	Orange
Bus	Apple
Train	Peach
Bicycle	Grape
Airplane	Strawberry
Boat	Grapefruit
Wheelchair	Watermelon
Sled	Date
Skates	Tomato
Elevator	Olive

Source: Adapted from Rosch & Mervis, 1975, p. 576.

Menu

Problem-Solving

- Problem solving - process of cognition that occurs when a goal must be reached by thinking and behaving in certain ways.
- Trial and error (mechanical solution) – problem-solving method in which one possible solution after another is tried until a successful one is found.
- Algorithms - very specific, step-by-step procedures for solving certain types of problems.

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Problem-Solving

- Heuristic - an educated guess based on prior experiences that helps narrow down the possible solutions for a problem. Also known as a "rule of thumb."
  - Means–end analysis - heuristic in which the difference between the starting situation and the goal is determined and then steps are taken to reduce that difference.
- Insight - sudden perception of a solution to a problem.

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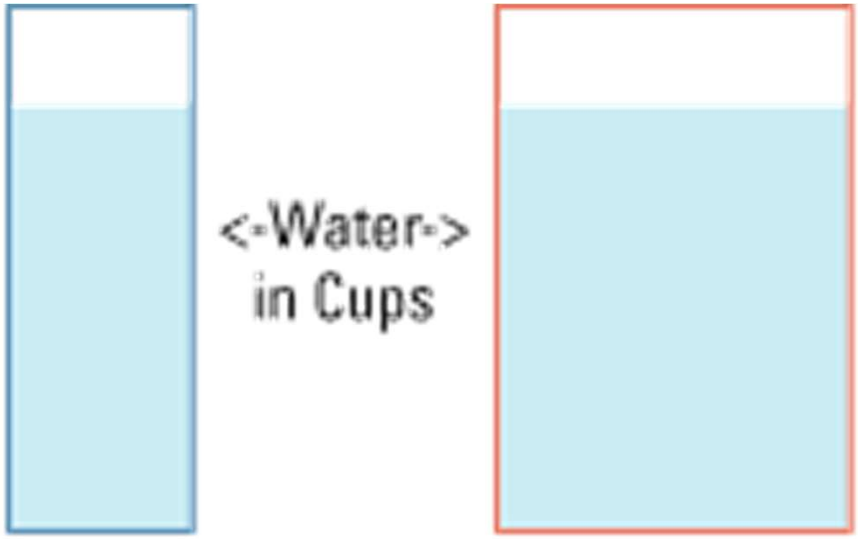
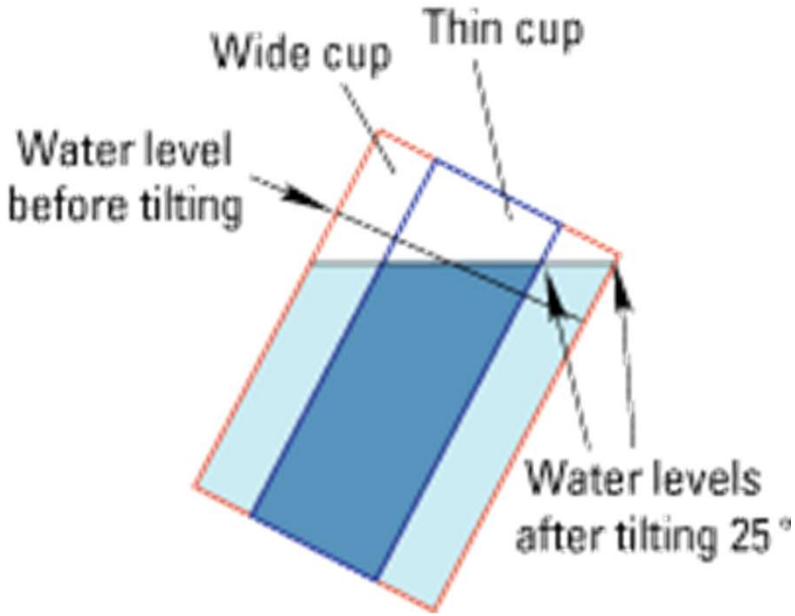
LO 8.3 Methods people use to solve problems and make decisions



If tilted, would the two cups pour at the same angle or at different angles?



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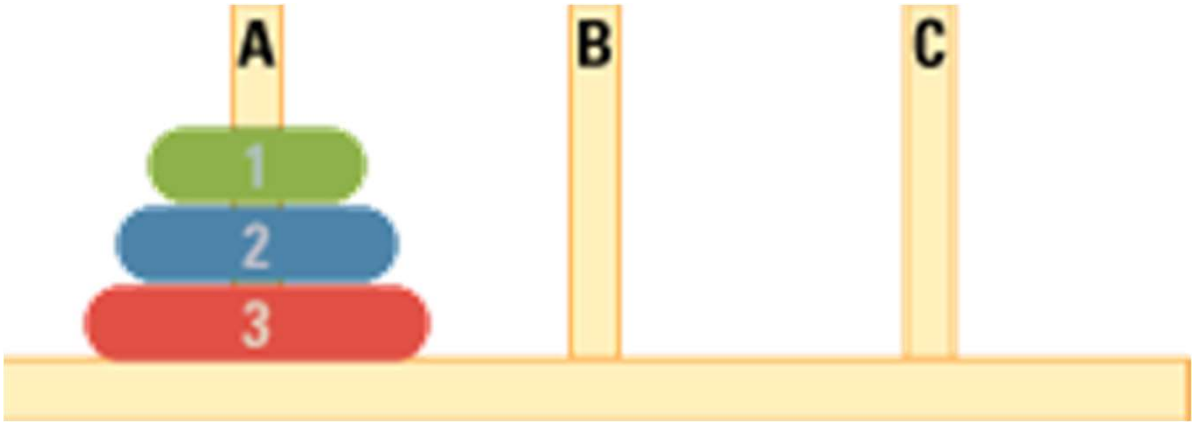
Tower of Hanoi



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Artificial Intelligence

- Artificial intelligence (AI) - the creation of a machine that can think like a human.

- True flexibility of human thought processes has yet to be developed in a machine.

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Problem-Solving Barriers

- Functional fixedness - a block to problem solving that comes from thinking about objects in terms of only their typical functions.
- Mental set - the tendency for people to persist in using problem-solving patterns that have worked for them in the past.
- Confirmation bias – the tendency to search for evidence that fits one's beliefs while ignoring any evidence that does not fit those beliefs.

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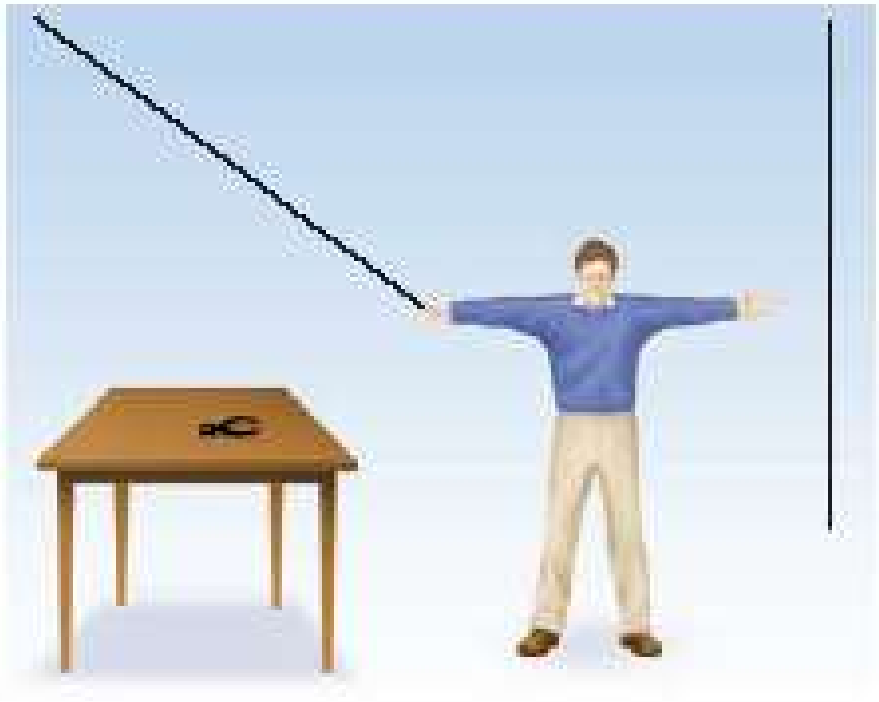
FIGURE 8.2 **The String Problem**



The string problem: How do you tie the two strings together if you cannot reach them both at the same time?

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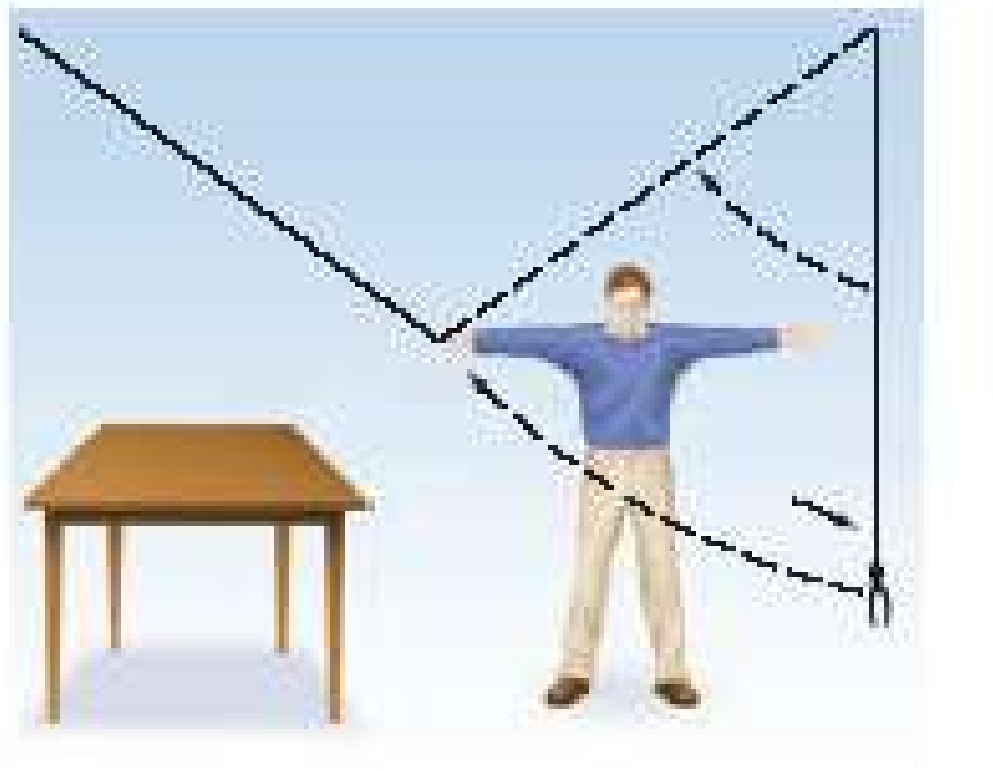
The solution to the string problem is to use the pliers as a pendulum to get the second string closer to you.

Solution to the String Problem



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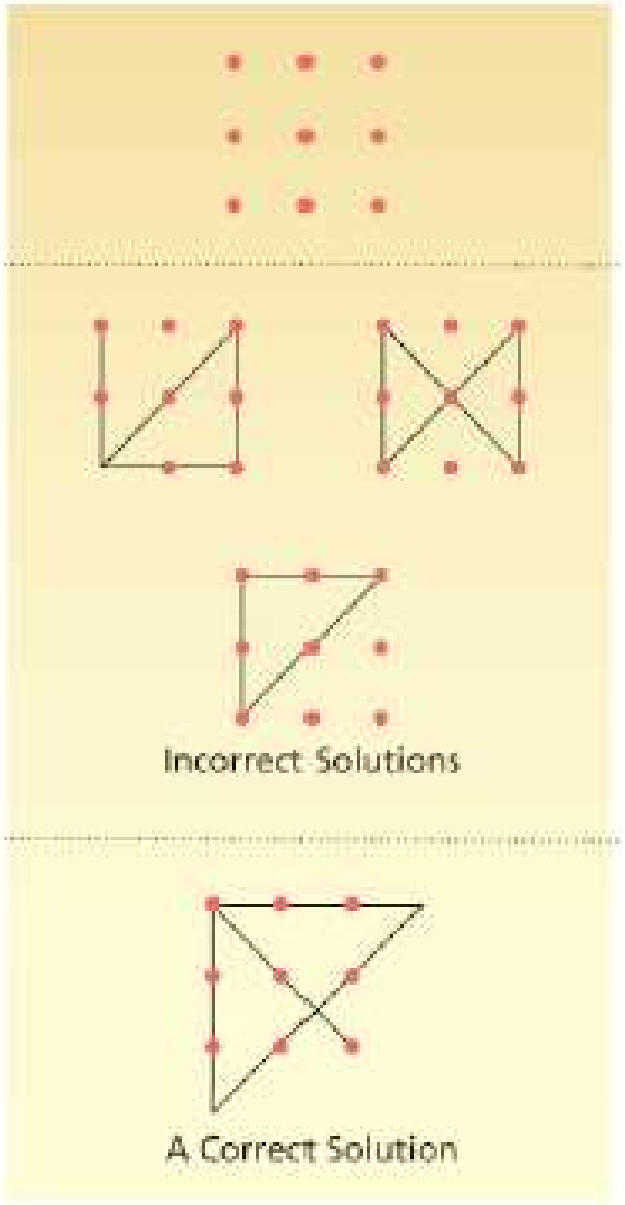
LO 8.5 Barriers to solving problems

FIGURE 8.3 **The Solution to the Dot Problem** When people try to solve this problem, a mental set causes them to think of the dots as representing a box, and they try to draw the line while staying in the box. The only way to connect all nine dots without lifting the pencil from the paper is to draw the lines so they extend out of the box of dots—literally "thinking outside the box."



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IQ Tests

- Intelligence quotient (IQ) - a number representing a measure of intelligence, resulting from the division of one's mental age by one's chronological age and then multiplying that quotient by 100.
- Stanford-Binet Intelligence Test yields an IQ score.
- Wechsler Intelligence Tests yield a verbal score and a performance score, as well as an overall score of intelligence.

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LO 8.8 How intelligence tests measure intelligence

TABLE 8.3 SAMPLE ITEMS FROM THE 1986 STANFORD-BINET INTELLIGENCE TEST

Examples of Items

Vocabulary Define words like train, wrench, letter, error, and encourage.

Comprehension Answer question like, "Why should people brush their teeth?" "Why should people be quiet in a library?" "What is one advantage and one disadvantage of living in a small town instead of a big city?"

Absurdities Identify the mistakes of "silly" aspects of pictures in which, for example, a man is shown using the wrong end of a rake or a girl is shown putting a piece of clothing on incorrectly.

Copying Arrange a set of blocks to match different designs; draw designs like those shown in pictures.

Memory for Objects Choose the right order in which a series of pictures were presented.

Number Series Determine which numbers come next in a series of numbers such as the following—32, 26, 20, 14, ___, ___.

Verbal Relations Indicate how three objects or words are alike but different from a fourth. For example, how are dog, cat, and horse alike, but different from boy.

Bead Memory Arrange beads of different colors and shapes to match pictures of the beads organized in different layouts.

From Nietzel et al. (1991).

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LO 8.8 How intelligence tests measure intelligence

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LO 8.8 How intelligence tests measure intelligence

TABLE 8.4 PARAPHRASED SAMPLE ITEMS FROM THE WECHSLER ADULT INTELLIGENCE SCALE (WAIS)

Verbal Scale	
Information	What is steam made of? What is pepper? Who wrote *Tom Sawyer*?
Comprehension	Why is copper often used in electrical wire? What is the advantage of keeping money in a bank?
Arithmetic	Three women divided eighteen golf balls equally among themselves. How many golf balls did each person receive? If two buttons cost $.15, what will be the cost of a dozen buttons?
Similarities	In what way are a circle and a triangle alike? In what way are a saw and a hammer alike?
Vocabulary	What is a hippopotamus? What does "resemble" mean?
Performance Scale	
Picture Arrangement	A story is told in three or more cartoon panels placed in the incorrect order; put them together to tell the story.
Picture Completion	Point out what's missing from each picture.
Block Design	After looking at a pattern or design, try to arrange small cubes in the same pattern.
Object Assembly	Given pieces with part of a picture on each, put them together to form such objects as a hand or a profile.
Digit Symbol	Learn a different symbol for each number and then fill in the blank under the number with the correct symbol. (This test is timed.)

Simulated items similar to those in the *Wechsler Adult Intelligence Scale*, Third Edition (2005).

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LO 8.8 How intelligence tests measure intelligence

TABLE 8.5 SAMPLE OF THE DOVE COUNTERBALANCE GENERAL INTELLIGENCE TEST

1. A "handkerchief head" is:
   a. a cool cat,
   b. a porter,
   c. an Uncle Tom,
   d. a hoddi,
   e. a preacher.
2. Cheap chitlings (not the kind you purchase at a frozen food counter) will taste rubbery unless they are cooked long enough. How soon can you quit cooking them to eat and enjoy them?
   a. 45 minutes,
   b. 2 hours,
   c. 24 hours,
   d. 1 week (on a low flame),
   e. 1 hour.
3. What are the "Dixie Hummingbirds"?
   a. part of the KKK,
   b. a swamp disease,
   c. a modern gospel group,
   d. a Mississippi Negro paramilitary group,
   e. deacons.
4. "Money don't get everything it's true"
   a. but I don't have none and I'm so blue,
   b. but what it don't get I can't use,
   c. so make do with what you've got,
   d. but I don't know that and neither do you.

The answers are as follows:

1. c. 2. c. 3. c. 4. b.

Source: Dove, A. (1971).

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Intelligence

- Intelligence - the ability to learn from one's experiences, acquire knowledge, and use resources effectively in adapting to new situations or solving problems.

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Development of IQ Tests

- Standardization - the process of giving the test to a large group of people that represents the kind of people for whom the test is designed.
- Validity - the degree to which a test actually measures what it's supposed to measure.
- Reliability - the tendency of a test to produce the same scores again and again each time it is given to the same people.

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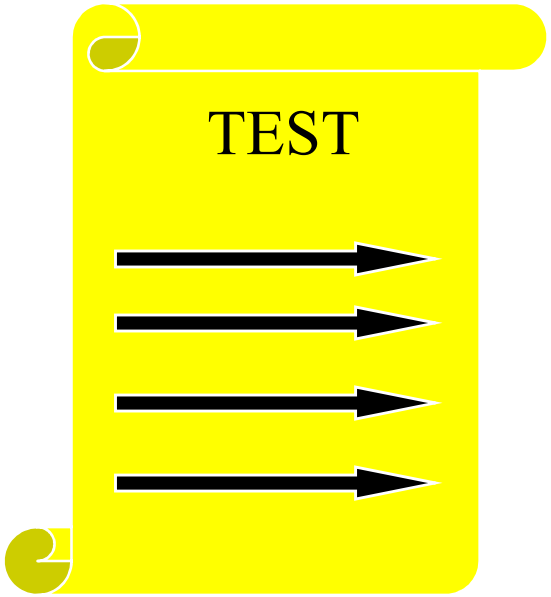
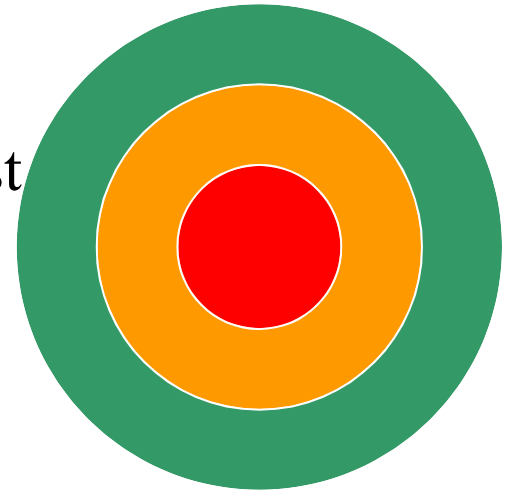
Unreliable and Invalid



Construct (i.e., “intelligence)

Scores on test



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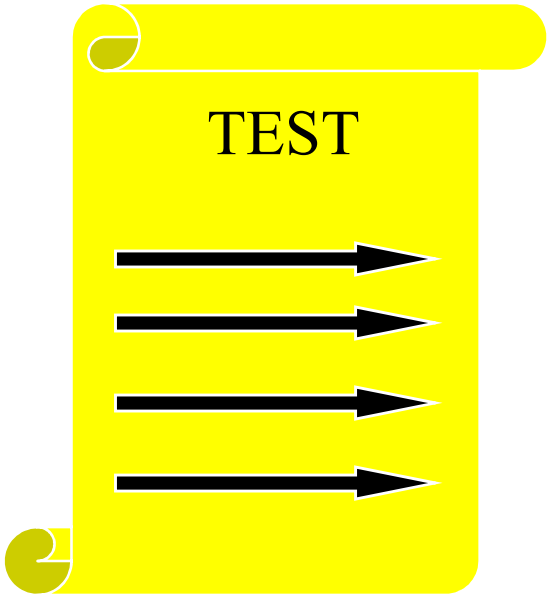
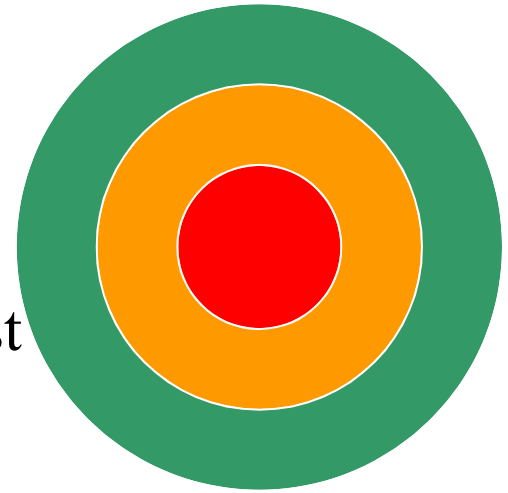
Reliable But Invalid



Construct (i.e., “intelligence)

Scores on test



Test can be RELIABLE but still be INVALID!

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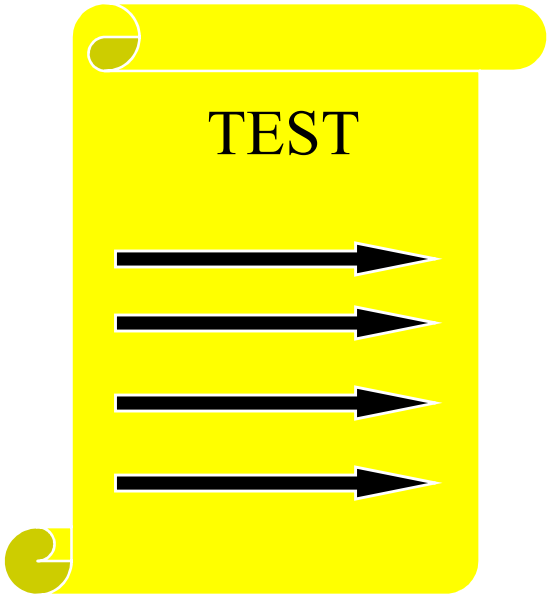
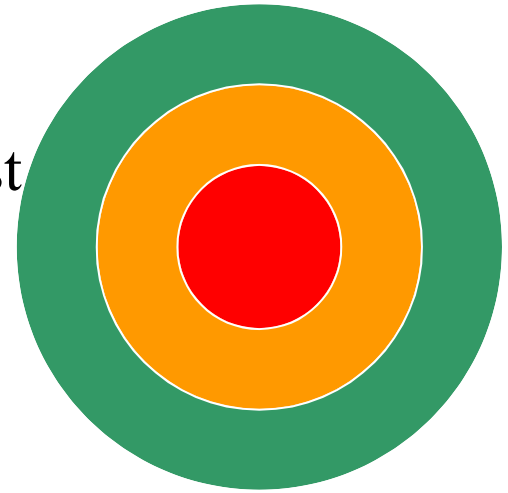
LO 8.9 How intelligence tests are constructed

Reliable AND Valid



Construct (i.e., “intelligence)

Scores on test



Test MUST be RELIABLE to be VALID!

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Development of IQ Tests

- Deviation IQ scores - a type of intelligence measure that assumes that IQ is normally distributed around a mean of 100 with a standard deviation of about 15.
  - Norms

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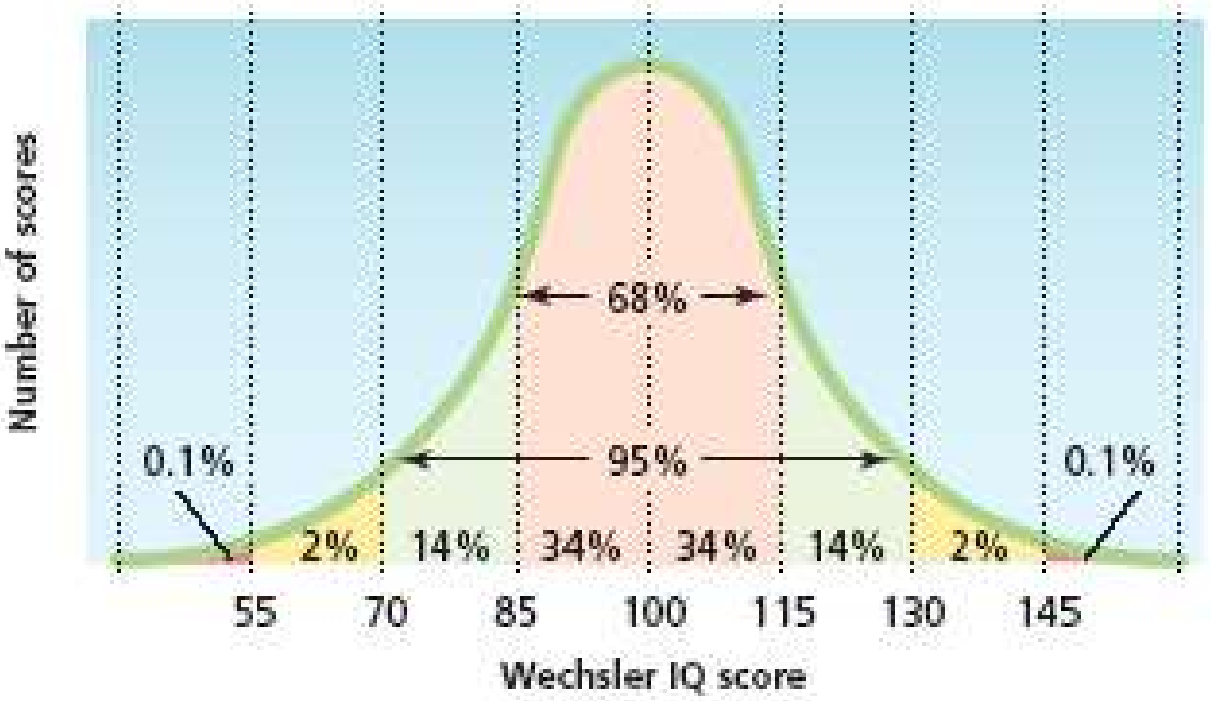
LO 8.9 How intelligence tests are constructed

FIGURE 8.4 **The Normal Curve**



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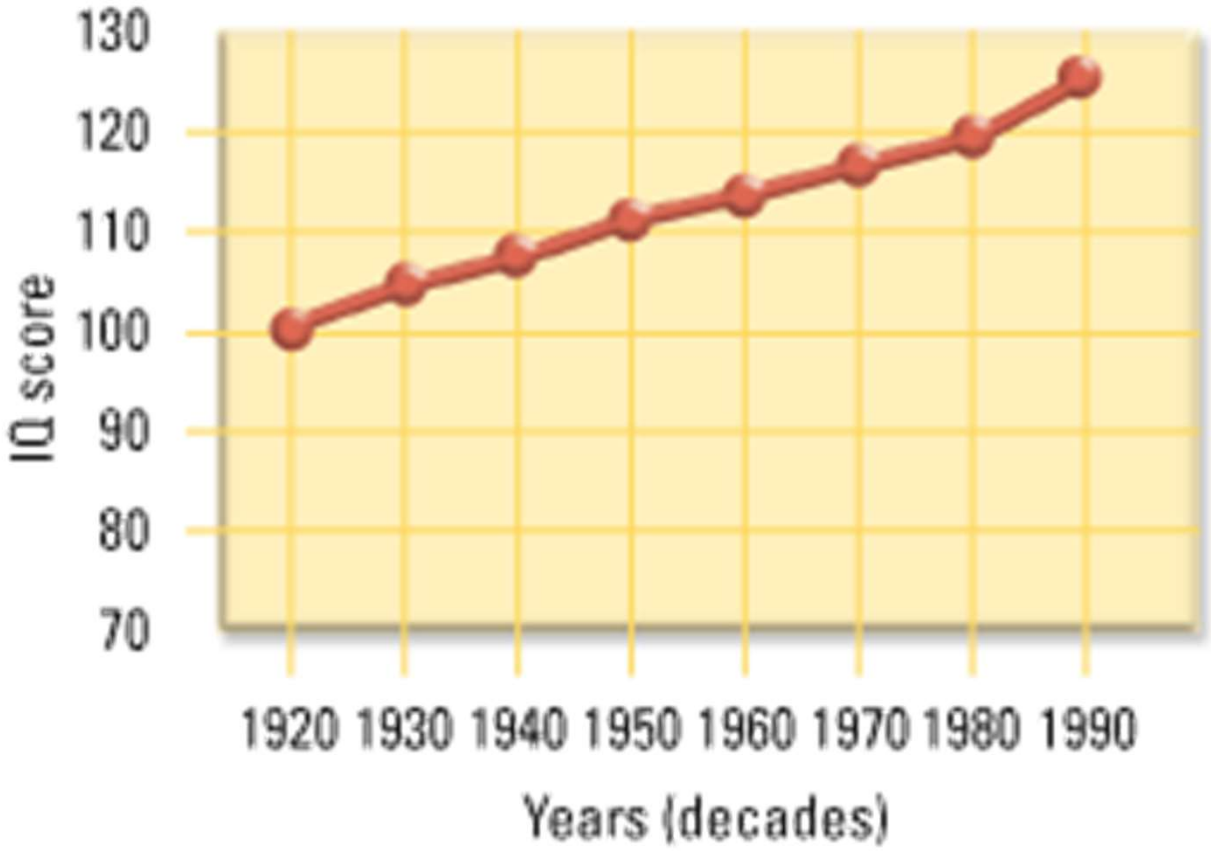
LO 8.9 How intelligence tests are constructed



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Mental Retardation

- Developmentally delayed - condition in which a person's behavioral and cognitive skills exist at an earlier developmental stage than the skills of others who are the same chronological age. A more acceptable term for mental retardation.
  - Mental retardation or developmental delay is a condition in which IQ falls below 70 and adaptive behavior is severely deficient for a person of a particular chronological age.

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Mental Retardation

- Four levels of delay are:
  - Mild: 55–70 IQ
  - Moderate: 40–55 IQ
  - Severe: 25–40 IQ
  - Profound: Below 25 IQ.

- Causes of developmental delay include deprived environments, as well as chromosome and genetic disorders and dietary deficiencies.

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LO 8.10 Mental retardation and what causes it

TABLE 8.6 CLASSIFICATIONS OF DEVELOPMENTAL DELAY

Classification	Range of IQ Scores	Adaptive Limitations	Percentage of Developmentally Delayed Population
Mild	55–70	Can reach sixth-grade skill level. Capable with training of living independently and being self-supporting.	90%
Moderate	40–55	Can reach second-grade skill level. Can work and live in sheltered environments with supervision.	6%
Severe	25–40	Can learn to talk and perform basic self-care but needs constant supervision.	3%
Profound	Below 25	Very limited ability to learn, may only be able to learn very simple tasks, poor language skills and limited self-care.	1%

Source: Table based on classifications in American Psychiatric Association. (2000).

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Creativity

- Creativity- the process of solving problems by combining ideas or behavior in new ways.
  - Convergent thinking - type of thinking in which a problem is seen as having only one answer, and all lines of thinking will eventually lead to that single answer, using previous knowledge and logic.
  - Divergent thinking – type of thinking in which a person starts from one point and comes up with many different ideas or possibilities based on that point (kind of creativity).

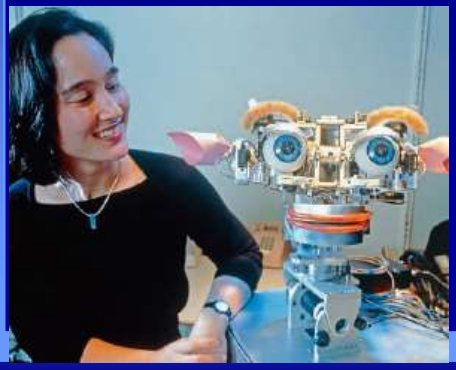

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TABLE 8.2 STIMULATING DIVERGENT THINKING

Brainstorming	Generate as many ideas as possible in a short period of time, without judging each idea's merits until all ideas are recorded.
Keeping a Journal	Carry a journal to write down ideas as they occur or a recorder to capture those same ideas and thoughts.
Freewriting	Write down or record everything that comes to mind about a topic without revising or proofreading until all of the information is written or recorded in some way. Organize it later.
Mind or Subject Mapping	Start with a central idea and draw a "map" with lines from the center to other related ideas, forming a mental image of the concepts and their connections.

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Giftedness

- Gifted - the 2 percent of the population falling on the upper end of the normal curve and typically possessing an IQ of 130 or above.

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Does Giftedness Guarantee Success?

- Terman conducted a longitudinal study that demonstrated that gifted children grow up to be successful adults for the most part.
  - Terman's study has been criticized for a lack of objectivity because he became too involved in the lives of his participants, even to the point of interfering on their behalf.

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Theories of Intelligence

- Spearman's Theory
  - g factor – the ability to reason and solve problems, or general intelligence.
  - s factor – the ability to excel in certain areas, or specific intelligence.
- Gardner's Theory
  - Multiple intelligences - ranging from verbal, linguistic, and mathematical to interpersonal and intrapersonal intelligence.

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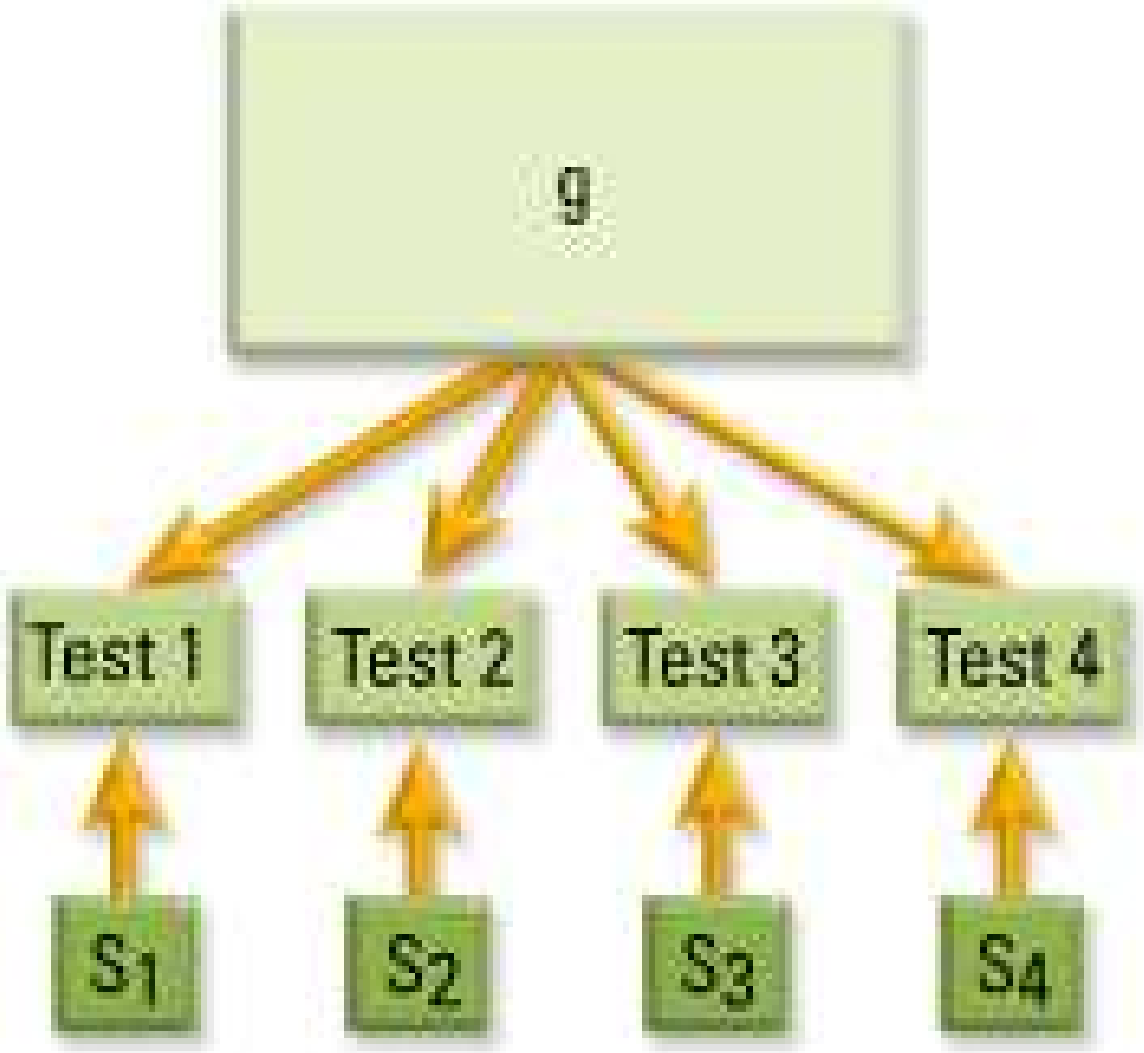
LO 8.13 Theories of intelligence and how they differ



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LO 8.13 Theories of intelligence and how they differ

TABLE 8.7 GARDNER'S NINE INTELLIGENCES

Type of Intelligence	Description	Sample Occupation
Verbal/linguistic	Ability to use language	Writers, speakers
Musical	Ability to compose and/or perform music	Musicians, even those who do not read musical notes but can perform and compose
Logical/mathematical	Ability to think logically and to solve mathematical problems	Scientists, engineers
Visual/spatial	Ability to understand how objects are oriented in space	Pilots, astronauts, artists, navigators
Movement	Ability to control one's body motions	Dancers, athletes
Interpersonal	Sensitivity to others and understanding motivation of others	Psychologists, managers
Intrapersonal	Understanding of one's emotions and how they guide actions	Various people-oriented careers
Naturalist	Ability to recognize the patterns found in nature	Farmers, landscapers, biologists, botanists
Existentialist	Ability to see the "big picture" of the human world by asking questions about life, death, and the ultimate reality of human existence	Various careers, philosophical thinkers

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According to Gardner, what kind of intelligence is being shown here?

Movement

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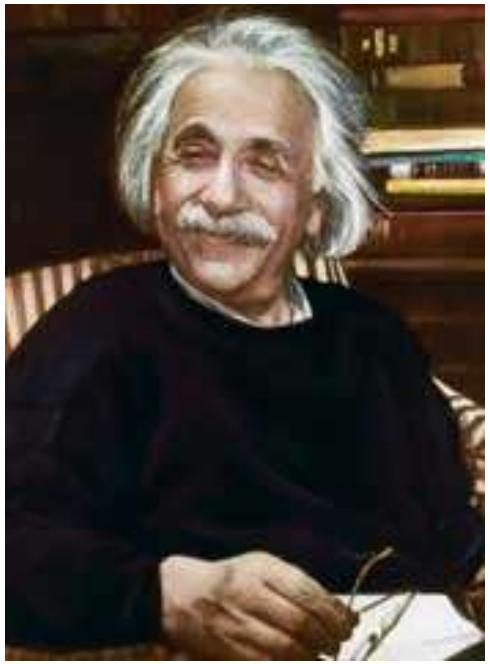
According to Gardner, what kind of intelligence is being shown here?



Albert Einstein

Logical-Mathematical

Menu

According to Gardner, what kind of intelligence is being shown here?

Visual-spatial

Menu

According to Gardner, what kind of intelligence is being shown here?

Musical

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Theories of Intelligence

- Triarchic theory of intelligence - Sternberg's theory that there are three kinds of intelligences: analytical, creative, and practical.
  - Analytical intelligence - the ability to break problems down into component parts, or analysis, for problem solving.
  - Creative intelligence - the ability to deal with new and different concepts and to come up with new ways of solving problems.
  - Practical intelligence – the ability to use information to get along in life and become successful.

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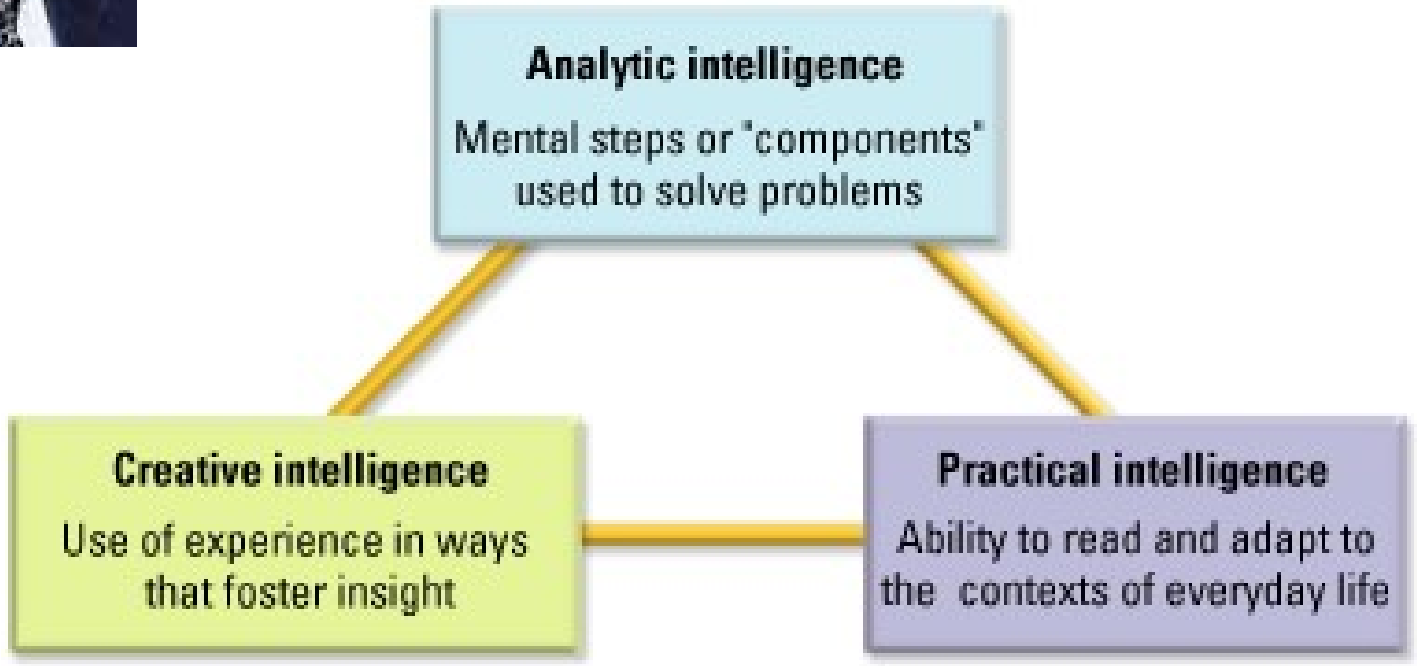
LO 8.13 Theories of intelligence and how they differ


Analytic intelligence
Mental steps or "components" used to solve problems
Creative intelligence
Use of experience in ways that foster insight
Practical intelligence
Ability to read and adapt to the contexts of everyday life

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Theories of Intelligence

- Emotional intelligence – the awareness of and ability to manage one's own emotions as well as the ability to be self-motivated, able to feel what others feel, and socially skilled. Viewed as a powerful influence on success in life.

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Heredity and Environment and Intelligence

- Stronger correlations are found between IQ scores as genetic relatedness increases.
- Heritability of IQ is estimated at 0.50.
- *The Bell Curve* - book that made widely criticized claims about the heritability of intelligence.

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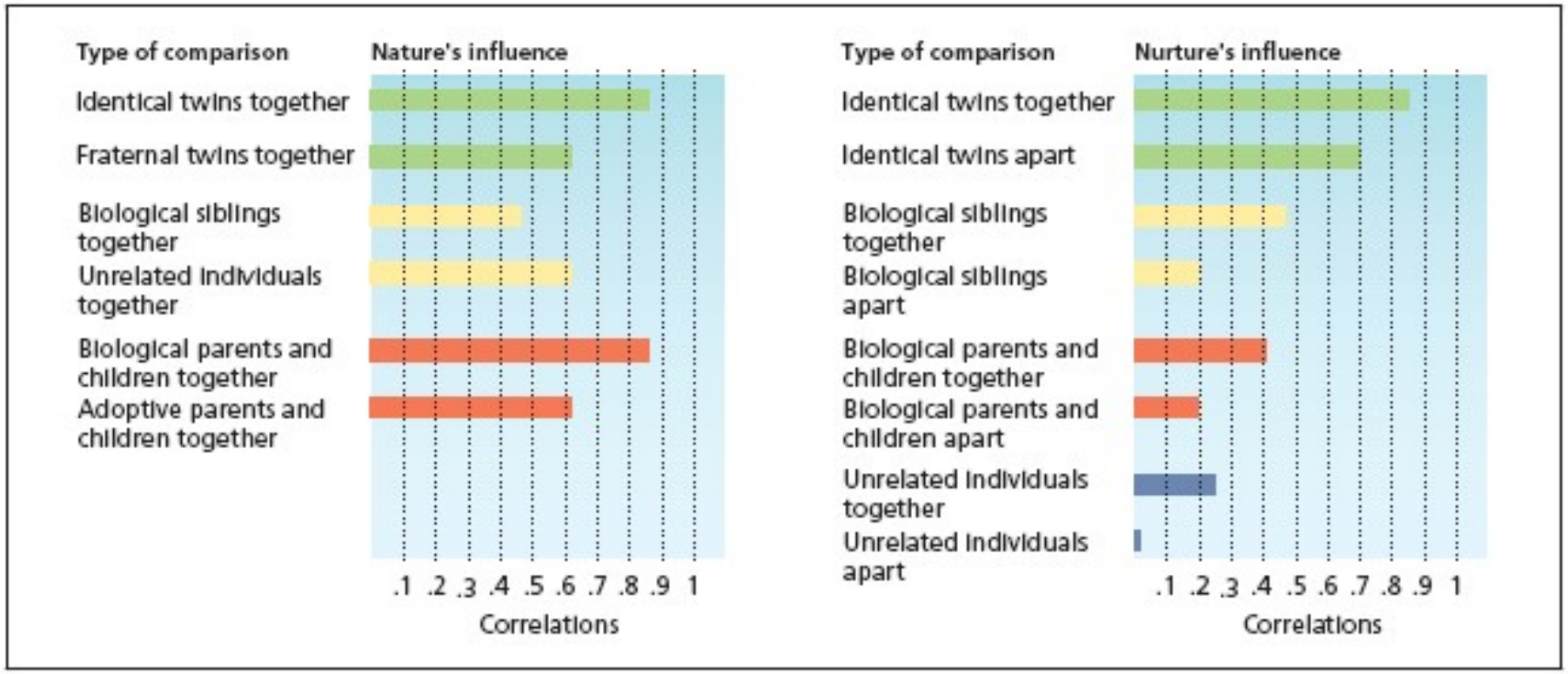
LO 8.14 Influence of heredity and environment on intelligence

FIGURE 8.5 **Correlations between IQ Scores of Persons with Various Relationships** In the graph on the left, the degree of genetic relatedness seems to determine the agreement (correlation) between IQ scores of the various comparisons. For example, identical twins, who share 100 percent of their genes are more similar in IQ than fraternal twins, who share only about 50 percent of their genes, even when raised in the same environment. In the graph on the right, identical twins are still more similar to each other in IQ than are other types of comparisons, but being raised in the same environment increases the similarity considerably.



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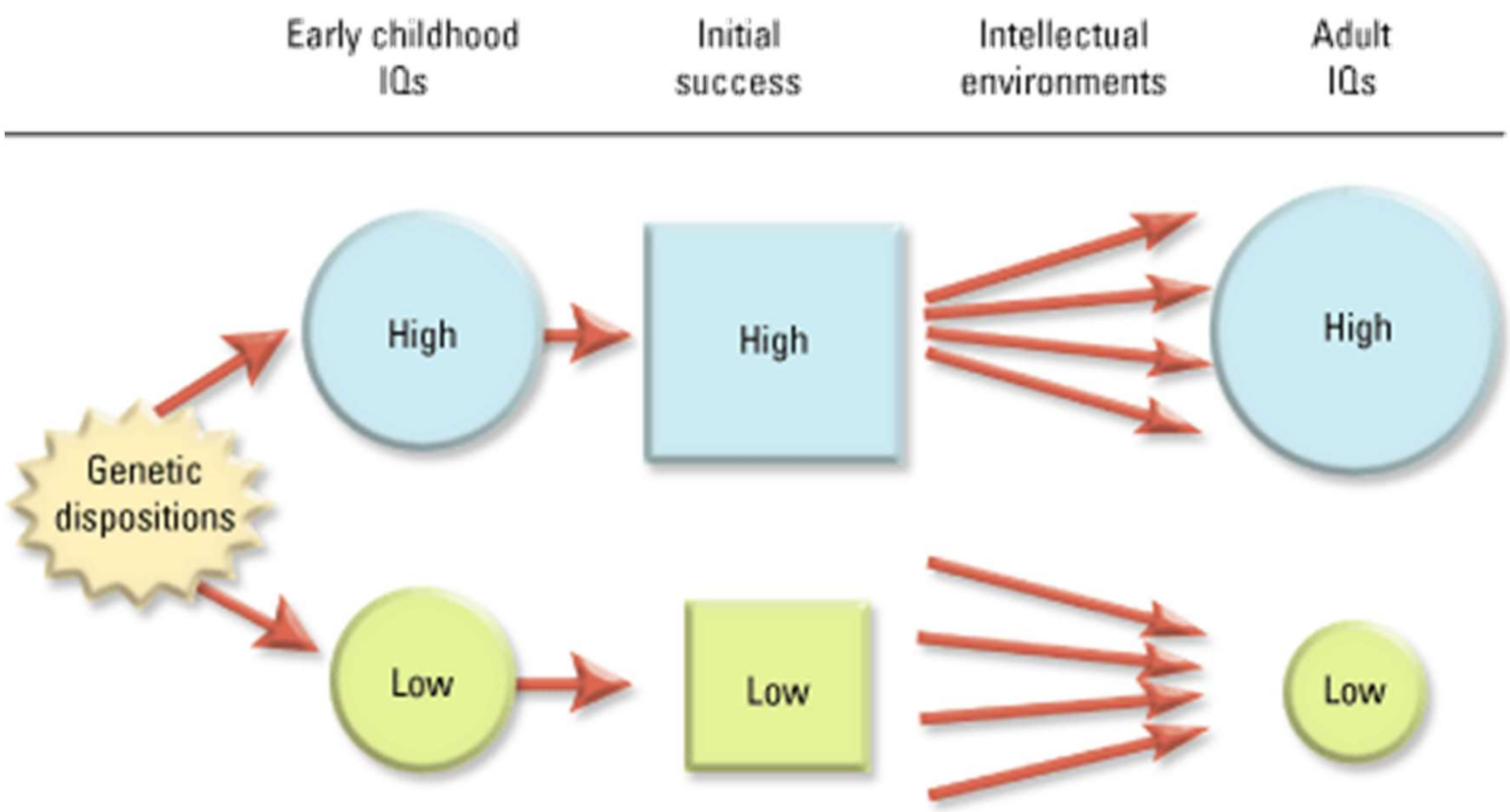
LO 8.14 Influence of heredity and environment on intelligence



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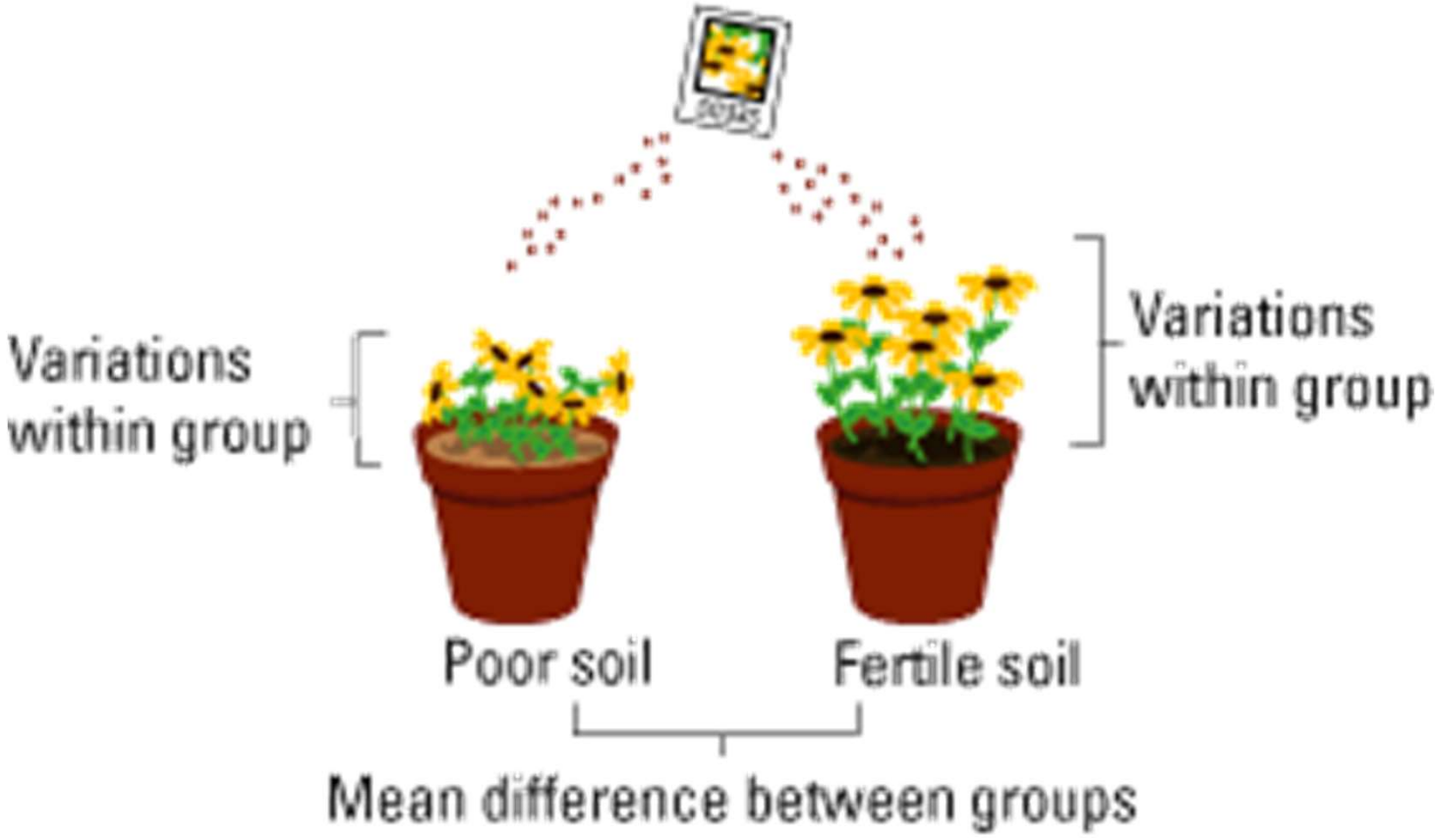
LO 8.14 Influence of heredity and environment on intelligence



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Language

- Language - a system for combining symbols (such as words) so that an unlimited number of meaningful statements can be made for the purpose of communicating with others.

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Elements and Structure of Language

- Grammar - the system of rules governing the structure and use a of language.
- Syntax - the system of rules for combining words and phrases to form grammatically correct sentences.
- Morphemes - the smallest units of meaning within a language.
  - Semantics - the rules for determining the meaning of words and sentences.

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Elements and Structure of Language

- Phonemes - the basic units of sound in language.
- Pragmatics - aspects of language involving the practical ways of communicating with others, or the social "niceties" of language.

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Language and Cognition

- Linguistic relativity hypothesis - the theory that thought processes and concepts are controlled by language.
- Cognitive universalism – theory that concepts are universal and influence the development of language.

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Animal Language

- Studies have been somewhat successful in demonstrating that animals can develop a basic kind of language, including some abstract ideas.
- Controversy exists over the lack of evidence that animals can learn syntax, which some feel means that animals are not truly learning and using language.

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LO 8.18 Animal capability of learning language

Kanzi looks at the keyboard used in teaching language to chimpanzees. Kanzi's language abilities were learned through watching the researchers train his mother rather than directly—much as a human infant learns through listening to the speech of adults.

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Ways to Improve Thinking

- Mental activity that requires creativity and the use of memory abilities, such as working crossword puzzles and reading books, can help to keep the brain fit.

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